

REMARKS

This application has been amended. The previously pending claims have been cancelled and replaced by claims 29-42, of which claims 29, 35 and 41 are in independent form. Support for these claims can be found in the claims and specification as originally filed, with special attention drawn to claims 1, 3, 4, 9, 10 and 18 and pages 4, 5, 8, 10 and 11 of the specification as filed. Thus, no new matter has been added.

Claims 1-3, 6, 9-12, 16, 20, 22, 23 and 25-27 were rejected under 35 U.S.C. § 103(a) for obviousness over WO 92/018249 to Beeby. Claims 4, 13-15 and 28 were rejected under 35 U.S.C. § 103(a) for obviousness over Beeby in view of the article *Microwave Energy for Mineral Treatment Process – A Brief Review* by Kazi Haque (“Haque”). Claim 17 was rejected under 35 U.S.C. § 103(a) for obviousness over Beeby in further view of GB 2,198,242 to De Beers Industrial Diamond Division (“De Beers”). Finally, claim 19 was rejected under 35 U.S.C. § 103(a) for obviousness over Beeby and further in view of Haque or U.S. 3,261,959 to Connell. While Applicants continue to disagree with each of these rejections, in an effort to expedite this application to allowance, Applicants have cancelled each of previously pending claims 1-4, 6, 9-17, 19, 20, 22, 23 and 25-28. Accordingly, each of the outstanding rejections is now moot. Claims 29-42 are now pending and, for the following reasons, these claims are believed to be patentable over the documents cited above.

Claims 29-42 are directed to a method of treating ore with microwave energy to facilitate subsequent processing of the ore by exposing ore particles to microwave pulses of energy of substantially above 1 kW per pulse and having a pulse duration of less than 0.1 second, such as less than 0.001 seconds, in order to produce micro-cracking or other physical changes within the ore particles without catastrophic destruction of the ore particles or significant alteration to the mineralogy of the ore. Such a method represents a significant and unobvious departure from the methods of treating ores described in the prior art of record, and particularly the Beeby document, which was the primary document relied on in the previous Office Actions. Thus, each of these claims is patentable over Beeby whether considered alone or in view of Haque and/or De Beers and/or Connell.

Beeby is directed to a method of recovering valuable materials from crushed ore by exposing the ore to pulses of microwave energy. Significantly, the pulses in Beeby are between 1 and 30 seconds in duration. Beeby does not teach, disclose or suggest exposing

ore to pulses of microwave energy having a duration of less than 1 second, much less a duration less than 0.1 seconds, as recited in claim 29, or less than 0.001 seconds, as recited in claims 35 and 41. In fact, the lower end of Beeby's disclosed range is 10 times greater than the upper end of the range recited in claim 29 and 1000 times greater than the upper end of the range recited in claims 35 and 41.

Despite the fact that the claimed pulse ranges differ from the range disclosed in Beeby by orders of magnitude, the Examiner contends that it is prima facie obvious to employ the claimed pulse ranges because doing so would represent nothing more than the optimization of a result-effective variable, citing for support MPEP § 2144.05 II B. (August 25, 2008 Office Action, page 3) However, the Examiner defines a "result effective variable" as "a variable which achieves a recognized result" but fails to establish what result one skilled in the art might be seeking to optimize by selecting a pulse range that is orders of magnitude lower than the lowest disclosed prior art value. The Examiner also fails to explain why the "result" of using such a short pulse range would be considered a "recognized result." As stated by Dr. Shaw, an expert in the field and a named inventor on the subject application, in his Declaration Under 37 CFR § 1.132 submitted June 30, 2008 ("Shaw Declaration"), Beeby teaches that the most important factor is the overall level of exposure of the ore through a combination of long duration pulses, not the importance of the energy level and use of short pulses. (Shaw Declaration, ¶ 9) Thus, it is far from apparent that the duration of the energy pulse would be considered a result effective variable at all.

Moreover, to the extent one skilled in the art would identify pulse duration as a result effective variable, Beeby only suggests a pulse duration in the range of 1 to 30 seconds. By definition, finding an "optimal" or "workable" value evokes the idea that an optimum value or workable range exists within the range disclosed in the cited prior art, or at least close to it. How, exactly, one seeking to optimize the 1-30 second range of Beeby would find it obvious to look to pulse durations that are 10 or even 1000 times lower than the disclosed range seems inconsistent with the spirit of "optimization" and clearly beyond that which would be considered routine experimentation. Instead, such a discovery is more akin to a new and unique invention entirely.

In addition, Beeby discloses a minimum time interval between pulses of between 10 and 90 seconds. Accordingly, the minimum treatment cycle (two pulses plus an interval between) would be 12 seconds. On the other hand, the subject application discloses a

treatment cycle of between 1 and 1.2 seconds (with the interval between pulses defined as 10-20 times the pulse duration). While the treatment cycle period is not a claim limitation, it further shows that Beeby would be read as directed to extended treatment periods and does not suggest short treatment periods as being consistent with its disclosed method.

Even assuming, for the sake of argument, that a prima facie case of obviousness has been established, “Applicants can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range.” MPEP § 2144.05 III While Applicants do not have overlapping ranges, the evidence is clear that the short energy pulses are not only critical to Applicants’ invention, but also provide advantages that are unexpected in light of Beeby. As stated by Dr. Shaw: “A key feature of the method [of the subject application] is the use of short duration pulses of microwave energy.” (Shaw Declaration, ¶ 6) Differential thermal expansion and the resulting high stress/strain regions which lead to microcracking occur due to the response of ore particles to pulsed microwave energy. (Shaw Declaration, ¶ 9) Short duration pulses are essential in achieving a very rapid differential heating between a first component, such as a susceptor mineral, and other minerals in the ore particles. (Id.) These short duration pulses allow very high energy microwaves to be provided to the susceptor minerals, which maximizes their expansion as compared to the expansion exhibited by other minerals in the ore. (Id.) According to Dr. Shaw, this phenomenon cannot be achieved using pulses of longer duration, such as those disclosed by Beeby, because the minerals become overheated and may even melt during such prolonged exposure to microwave energy. (Id.) In fact, with respect to some minerals, longer low energy pulses may not even cause microcracks at all because the heat transfer between the different phases which causes microcracking may be alleviated prior to the cracks forming. (Id.)

According to Dr. Shaw, the ability to generate such high stresses with very short pulse durations was an unexpected finding not disclosed by Beeby. (Id.) Additionally, Dr. Shaw notes that use of a short pulse time enables the application of microwaves in a “flow-through” type application system where the ore is exposed while traveling along a chute or conveyor belt, which would not be possible if a longer exposure time were necessary, such as in Beeby where the ores are kept in a microwave furnace for an extended time. (Shaw Declaration, ¶ 12) Thus, Applicants submit that a method of treating ores by subjecting them to a pulse of microwave energy of less than 1 second in duration such as, for

example, less than 0.1 seconds or less than 0.001 seconds, represents a significant and critical distinction from the method of Beeby, with unique advantages and results not found or contemplated in Beeby.

The Examiner takes the position that this Declaration is insufficient to overcome the obviousness rejection of, among others, claims 9 and 10 (which recited a pulse range of less than 0.1 seconds or less than 0.001 seconds, respectively) over Beeby because a “prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties.” (August 25, 2008 Office Action, pages 7-8) However, in addition to this not being a case where the prior art range and claimed range are even “close,” much less “close enough,” Applicants respectfully submit that one skilled in the art would not consider the pulse durations of Beeby and the pulse durations of the claims to have the same properties. As recited above, Dr. Shaw clearly points out that pulses of short duration, like that recited in the claims, allow very high energy microwaves to be provided to the susceptor minerals which maximizes their expansion compared to the non-susceptor minerals and therefore maximizes the stresses generated. As Dr. Shaw then states: “This cannot be achieved using the longer pulses, and extended exposure times, as disclosed by Beeby”. (Shaw Declaration, ¶ 9, emphasis added) Thus, the rationale in the Office Action that the prior art ranges (i.e. the 1-30 second range in Beeby) are close enough that one skilled in the art would expect them to have the same properties as the claimed ranges (i.e. less than 0.1 or 0.001 seconds) is completely unfounded for at least the reason that the prior art and claimed pulse ranges do not produce the same properties. Moreover, Applicants’ inventive method includes surprising results that were not expected in view of Beeby. As Dr. Shaw states: “This ability to generate high stresses with very short pulses and the importance of energy level was an unexpected finding for me and is not disclosed by Beeby”. (Shaw Declaration, ¶ 9, emphasis added)

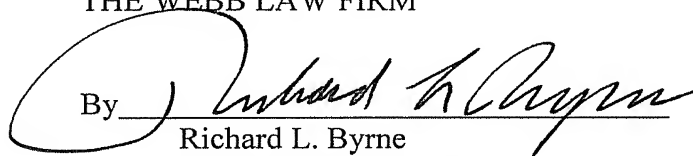
Thus, in assuming that the pulse ranges recited in the claims are “close enough” to the prior art ranges to amount to nothing more than an obvious variation producing similar properties, the Examiner not only disregards clear evidence to the contrary, but takes a position as to the obviousness of the invention that is in clear conflict with the opinion of a skilled artisan. Moreover, this conclusion is reached with virtually no counterargument or other evidence outside of several unsupported (and inapplicable)

statements from the MPEP. Applicants respectfully submit that such a course of action is improper and should be reconsidered. Therefore, the pending claims are not obvious in view of Beeby, whether considered alone or in view of Haque, De Beers or Connell.

For the foregoing reasons, Applicants submit that the pending claims are patentable over the prior art of record and are in condition for allowance. Reconsideration of the outstanding rejections and allowance of pending claims 29-42 are respectfully requested.

Respectfully submitted,

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